Project PI	coPI	Title	Agency	Amount Requested	Date Submitted	Status	Description (Abstract/Summary)
K. Angerson	C. Barrows	Collaborative Project: Integrating Ecology and Geomorphology to Model the Effects of Multiple Disturbances on Biodiversity in Desert Sand Dune Ecosystems	NSF Ecosytems	$576,373	1/9/2009	Pending	Our proposal centers on a novel multidisciplinary integration of modeling, geomorphology, and empirical quantification of ecological relationships. Geomorphic and ecological analyses will iteratively feed into the development of predictive models of how abiotic and biotic forces interact to affect biodiversity in dunes across the three distinct climatic regimes of the Mojave, Sonoran, and Chihuahuan deserts. We will use extensive existing data bases and field work across strong disturbance gradients of the Coachella Valley dune system in the Sonora desert to empirically quantify the effects of rainfall, sand transport, dune stabilization, and competition on the relative survival and biomass production of dune species. We will quantify the responses of three classes of vegetation that we hypothesize will exhibit differential responses to disturbances and dune stabilizing ability: stress adapted annuals that thrive under lower water and higher sand transport activity but exhibit less stabilizing ability, stress intolerant competitive perennials that thrive under higher water and lower sand activity but exhibit higher stabilizing ability, and stress tolerant perennials whose traits are intermediate between these two. Associations between these vegetation types and arthropod and vertebrate assemblages will also be quantified. These data will parameterize and refine mathematical models which will be tested on biodiversity patterns observed in the Kelso Dunes in the Mojave Desert and the Viesca Dune system in the Chihuahuan Desert.Our empirically parameterized and validated models will then be used to forecast how predicted changes in disturbance regimes across southern North America will alter patterns of dune biodiversity.
C. Barrows	M.F. Allen J.T. Rotenberry	Modeling Current and Future Distributions of Targeted Species in the Greater San Jacinto-Santa Rosa Mountains National Monument Ecosystem	USDI BLM National Landscape	$16,315	5/15/2009	Initial Approval Received	Our proposal focuses on creating a geo-referenced database for habitat features and species distributions in the greater San Jacinto and Santa Rosa Mountains National Monument region. This base map data base will then serve as a foundation for creating niche models of selected species, allowing us to describe those habitat features that influence the distribution of suitable habitat for those species, and then create a map (model) of that distribution. These models will create a Basic Understanding of the habitat variables that influence the distribution of resources within these NLCS lands. By comparing the modeled (idealized) distribution of suitable habitat with current occupied habitat we can then identify barriers to connectivity, stressors and other features that may constrain that species' distribution, and so provide a foundation for future research and adaptive management. Secondly, these niche models become a baseline for modeling the sensitivity of species to expected climate change. By shifting the base-map database's climate parameters we can model where suitable habitat areas will likely shift to, identify critical areas of habitat connectivity so that species can track their preferred climate envelopes, and identify whether there are additional lands to be acquired. This will serve as critical Applied Science support for management and acquisition actions to ensure that the NLCS resources can be sustained in the event of those climate shifts.
H. Regan	C. Barrows K. Anderson	Dynamic Decision Making Under Risk and Uncertainty for Management of Species Threatened by the Fire/Invasive Species Cycle	Research & Engineering	$1,552,301	3/12/2009	Pending	The aim of this proposed research is to develop and apply a decision making framework to inform management of fire-dependent native species and habitats on lands in the southwest. Our proposed framework will allow management such that the impacts of invasive species are minimized while native species persistence is maximized and natural fire regimes are restored to the extent feasible. The target species will be threatened, endangered and at-risk species whose life cycles rely upon fire (or who have habitat requirements reliant on fire (e.g.oak woodlands for the Mexican spotted owl and Gould's turkey at Fort Huachuca). We will use stochastic dynamic programming, namely Partially Observable Markov Decision Processes (POMPD), to identify optimal management decisions under risk and uncertainty while explicitly addressing the dynamic feedback loop between fire and invasive species and its effects on species of concern and their habitats. The POMDP models a decision process in which it is assumed that the system dynamics are partly random and partly under the control of the decision maker (because the decision maker is implementing actions through time). The decision maker cannot directly observe the underlying state at any future point in time because s/he cannot predict the future with certainty. Instead, the decision maker must infer a distribution over future states based on a model of the world and some local observations. POMDP uses a stochastic dynamic programming technique characterized by a set of states (e.g. locations of invasive species; locations of native species; occurrence of fire); in each state and at each time step, there are several actions from which the decision maker must choose (e.g. burn, not burn, suppress fire, introduce grazing, create fire break). A decision maker is rewarded for desirable state transitions (e.g. from high fire frequency to low fire frequency, or from unsuitable habitat to suitable habitat, from low population persistence to high population persistence). The aim is to maximize some cumulative function of rewards (e.g. probability of population persistence, reduction of fire frequency, extent of suitable habitat for TER species). A decision maker chooses the set of actions over time that maximizes this reward function. Our proposed interdisciplinary research will link the following set of components: Species distribution models and habitat suitability maps for TER species and invasive species under current conditions and future climate change scenarios (predicted out to decades); Spatially explicit fire probability models under current conditions and future climate change scenarios and vegetation dynamics (predicted out to decades); Spatially explicit population models for TER species and invasive species under current conditions and future climate change scenarios, where data availability allows

							(predicted out to decades); Empirical information on the effects of climate change on recruitment events for TER plants and invasive plants collected through growth chamber experiments under a range of temperatures, precipitation, and CO2 levels predicted by climate change; and Dynamic decision making methodology (POMDP), linked to the modeling output and data components above, for identifying optimal management decisions under risk and uncertainty.
E. Allen	D. Jenerette M.F. Allen A. Dinar A. Bytnerowicz	Thresholds of Ecosytem Sustainability for an Expanding Urban Region	NSF ULTRA-EX (LTER)	$298,497	1/1/2010	To be submitted 07/07/2009	The expansion of urban regions into surrounding ecosystems may be accompanied by a reduction in ecosystem services for humans as well as conservation services for wildland organisms. The degree to which these services are reduced will determine the sustainability of the urban-wildland system. We postulate that there are thresholds of sustainability for various parameters that are critical to both human-dominated and wildland ecosystems, that can be measured based on materials (water, carbon, nutrients), energy (solar, wind, and fossil fuel), economics (monetary capital), and human capital. We propose to examine the inputs, outputs, and internal fluxes of energy, materials, and monetary and human capital in an urban area undergoing rapid expansion in an ecosystem with low resilience. We will also study the impacts of climate change in conjunction with these local urbanizing influences, as climate change has caused alterations in ecosystem dynamics and species shifts in the study area. The Coachella Valley of southern California was chosen, because it forms a bounded basin suited for measurements of fluxes; has an arid ecosystem sensitive to urban impacts, and limited water supplies; and a rapidly growing population including the poorest agricultural communities and the wealthiest urbanites in the United States. We propose to develop an ecoinformatics database with the objectives of assessing 1) inputs, outputs, and internal fluxes of water, C, N, energy, monetary capital, and human populations; 2) sustainability of ecosystem services (water, C, sensitive human populations, endangered/rare species); 3) the role of wind and solar energy to increase the sustainability threshold; 4) the value of land areas for human ecosystem services compared to conservation services; and 5) impacts of economic cycles on land use change, to changes in water use, and vegetation change. Resurvey data will be collected from a 1970's vegetation survey to assess urbanization and climate change impacts. We will analyze data on land use change from remote sensing imagery, government data on water use, C sequestration, climate, economic, air quality, and biodiversity data sources.